REMARKS

Claims 1-11 and 15-16 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over AMANN, et al. The Examiner incorrectly states that AMANN teaches a halide at column 5, line 2. AMANN teaches chloroperoxidase. The Examiner further states that ALLAN teaches that a haloperoxidase ia a peroxidase plus a halide or a combination of halides in his abstract. A careful reading of ALLAN shows that Allan teaches solutions containing a haloperoxidase plus a halide or combination of halides. This clearly differs from a teaching that a haloperoxidase is a peroxidase plus a halide.

As previously stated, chloroperoxidase does not contain any chloride. It is an enzyme (protein) composed of amino acids and a heme center. See Griffin already of record. Further, Applicants enclose the structure of vanadium chloroperoxidase (VCPO) from the internet which shows that it is a protein and the accompanying article which states that it is an enzyme composed of amino acids.

Also of record is the Cui declaration in which Dr. Cui concludes that chloroperoxidase contains no chloride. The Examiner was unpersuaded as "whether chloride will precipitate out of chloroperoxidase is not the issue." Applicants disagree. The present invention claims a method of oxidizing carbohydrates comprising placing halide in solution. If chloride was present in a solution of chloroperoidase, it would precipitate out.

Thus, as chloroperoxidase does not contain a halide and the present invention claims a method in which a halide is present, AMANN does not anticipate or obviate the present invention.

In view of the foregoing, Applicant submits the Application is now in condition for allowance and respectfully requests early notice to that effect.

Respectfully submitted,

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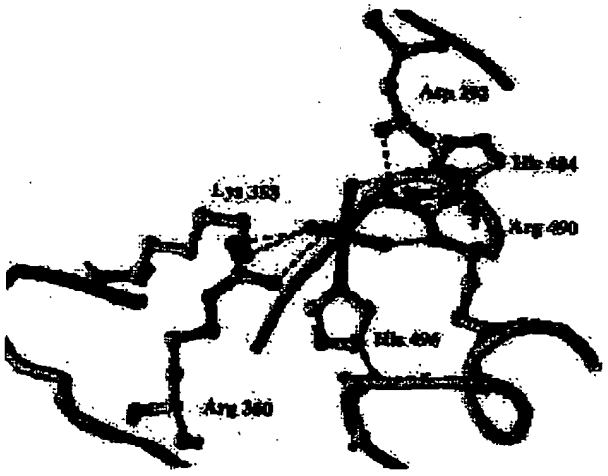
Vanadium chloroperoxidase: mechanism of action and X-ray structure

Vanadium chloroperoxidases catalyse the oxidation of an halide by hydrogen peroxide to hypohalous acid. The X-ray structure of the vanadium chloroperoxidase has been determined by us in cooperation with A. Messerschmidt (Martinsried) at high resolution and details of the active site which consist of orthovanadate are known.

As we have shown these haloperoxidases are related to a group of acid phosphatases and the structure of the active site in the vanadium haloperoxidases and the residues binding the vanadate are the same as in these phosphatases which bind and hydrolyse phosphate esters

By site-directed mutagenesis we have been able to selectively replace amino acids in the active site of the vanadium chloroperoxidase. The effects of these mutations on the catalytic properties have led to a better understanding of the molecular events that occur at the active site during the catalytic process. Modification leads to loss of chlorinating activity although some of the mutants retain brominating activity. We have concluded that we deal with an intricate balance of charges and and protonation of active site resides which steers the reactivity of the enzyme. Any disturbance around the active site converts the chloroperoxidase into a bromoperoxidase. The X-ray structure of an important enzyme intermediate, the vanadium peroxo species has been determined also in collaboration and we have obtained detailed insight of how this intermediate reacts with halides. Also X-ray structures of mutants have been obtained and these structures confirm that the active site of the enzyme is a rigid matrix that binds the orthovanadate. As we have shown these enzymes in the presence of hydrogen peroxide also slowly mediate the enantioselective oxidation of organic sulfides to the corresponding sulfoxides. The vanadium bromoperoxidase converts aromatic sulfides enantioselectively to the (R)-enantiomer of the sulfoxide with high (85% - 91%) enantiomeric excess (ee). We have been able to show using 18O labelled hydrogen peroxide that all oxygen in the sulfoxide is derived from peroxide.

This demonstrates that the vanadium peroxocomplex in the enzyme is able to transfer directly an oxygen atom to the sulfide. In contrast, the vanadium chloroperoxidase from the fungus Curvularia inaequalis catalyzes the production of a racemic mixture which seems to be an intrinsic characteristic of this enzyme. We are presently studying the structural factors which determines the enantioselectivity of this process by studying various sulfoxidation reactions.



Active Site of YCPO *Curvularia inaequalis*